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The June 2014 eruption of Piton de la Fournaise: Insights from field, textural and geochemical data

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The June 20^{st}, 2014 eruption of Piton de la Fournaise (PdF) represents the first eruption after 3.5 years of quiescence of this very active basaltic volcano. The eruption occurred on the SE slopes of the central cone and was short-lived, lasting only 20 hours and producing a short (1.5 km long) lava flow and a very weak (low) hawaiian to strombolian activity along the eruptive fissure.

Here we discuss the first detailed dataset on PdF products integrating field, componentry, texture and chemical data on the 2014 eruptive products. The most intense activity occurred close to the lower tip of the eruptive fracture and dispersed a very small scoria fall out deposit. The deposit is inversely graded from lapilli to bombs, with minor coarse ash and comprises mainly juvenile scoriae with (very) minor, non-juvenile fragments of old scoriae and lava. The juvenile component is characterized by three groups of scoria: (i) spiny-opaque, (ii) spiny-iridescent, and (iii) fluidal, along with golden pumice. Density analyses performed on 200 coarse lapilli reveal a correlation between porosity and morphology, so that the spiny-opaque clasts are the densest (up to 1.60 x 10^3 kg m^{-3}, for a vesicularity of 45%) and the golden pumice are the lightest (minimum density of 0.4 x 10^3 kg m^{-3} for a vesicularity of up to 86 %; DRE: 2.88 x 10^3 kg m^{-3}). The increase in vesicularity correlates with an increase in number of small vesicles and a decrease in the large, coalesced vesicles. The connectivity data also indicate that the fluidal and golden (hawaiian-like) clasts have more isolated vesicles (up to 40%) than the spiny (strombolian-like) clasts (0-5%). The strong variation in density is controlled not only by the vesicularity, but also by the crystal content: the densest, spiny opaque fragments are the richest in microphenocrysts and microlites of plagioclase, pyroxene and olivine. The glass chemistry of each of the four clast types allows us to correlate porosity and oxide content: while MgO increases (from 4 to 6%) with porosity, FeO_t decreases (from 18 down to 11%) evidencing the relatively more primitive signature of the lightest component. The spiny-opaque fragments are always mingled with fresher, microlite-poorer magma at their edges. The observed trends can be explained by variation in magma degassing and ascent velocity. We interpret the fluidal and golden fragments to be the fastest and less degassed magma that arrived from a relatively deeper source. The ascent of this small volume of magma triggered the eruption and underwent rapid decompression as is apparent from the large number of small vesicles, low microphenocrysts content and almost no microlites. The densest, spiny scoriae are thus old, shallow and degassed magma (possibly emplaced during the large 2007 eruption) that was passively involved in the event. This interpretation is consistent with the very shallow location of pre- and syn-eruptive seismic hypocenters ($<$ 2 km below volcano summit) and the short duration of geophysical and geochemical precursors.